

# Botanical Garden as a Laboratory for Outdoor Science Education

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**Abstract**—In today's world, thousands of species of tropical flora are used in medicines, yet our scientific knowledge that is relevant to sustainable utilization of these plants is limited. It was the landmark in the history when the idea of development of Botanical garden was originated in the human's mind. As the knowledge about plants became progressively scientific, many pleasure gardens were converted into Botanical gardens, which is not only became the center of advanced learning but also began to play a vital role in the economic and aesthetic needs. Therefore Conservation of medicinal plants involved the sustainable utilization of medicinal plant resources that is in such a way that they satisfy the needs of today's generation without hindering the ability of tomorrow's generations to satisfy their own needs. This can easily be simplified as, "when you are eating today, remember to leave some for those who will be there tomorrow". The ever declining natural habitats of these medicinal plants have left only a choice of ex-situ conservation. This paper will discuss on established Botanical garden in Regional Institute of Education, Bhubaneswar with objectivity to utilize Botanical garden as a laboratory for out-door science education to both the pre-service students and in-service training programs of NCERT. Since the establishment of Botanical garden in 2016-17 extending the training and exploring the facilities to the DMS students and regional institute students to complete their projects, assignments and dissertation work, in the interest of career development and academic achievements. The Botanical garden is used for the purpose of outdoor science laboratory for the DMS school children and development of skill enhancement for pre-service students to achieve their academic goals and employment perspective.

## Introduction

A garden means different things to different people, and the kinds of garden run the alphabet from alpine to zoological garden. The English word "garden" is derived from Old High German "gart" – an enclosure particularly containing plants. The term garden is also akin to the term paradise. Among rainforest dwellers, their term includes planting around the house, cultivated field and even the adjacent forest. Gardens, in the broader sense encompass a diverse array of plant collections. Botanical garden is a place where collection, cultivation and study of plants, serving a variety of scientific, educational and aesthetic purposes are carried out. Wyse Jackson (1999) offered a similar definition "an institution

holding documented collections of living plants for the purpose of scientific research, conservation, display and education." [15] Botanic gardens are generally walled which display a wide range of plants suitable for various environments appropriately labelled with Botanical names. Many visitors come to the Botanical garden to enjoy the plants and their pleasant surroundings. Most of them are devoid of the idea that these plants also hold fascination history and great practical views [16]. Botanic gardens play a perfect complementary role in supplementing and enriching the formal system of education. However, when they were initially established, their remit was not as complex as it is today, in that their role has been extended to encompass the challenge of holding documented plant collections of living flora for the purposes of: scientific research, conservation, display and education [1]. This paper will explore the concept of Botanical garden seen as a dynamic space where scientific experiment in conservation, plant propagation and investigatory projects for outdoor learning could occur in RIE, campus.

## History and position of Botanical garden

The origin of modern Botanic garden started in the 16<sup>th</sup> century. Their function was purely the academic study of medicinal plants [3], and by the seventeenth century, these medicinal gardens had spread to universities and apothecaries across Europe [2]. When it came to the late seventeenth and early eighteenth centuries, Botanic gardens began to feature in and contribute to the development of Botany as a scientific discipline [2]. In the 18<sup>th</sup> century, gardens have traditionally been viewed as a space designed for leisure and represents political status, power and taste. In the 19<sup>th</sup> century Botanical garden became the centre of extensive Botanical research, which resulted in mass conservation of various species of plants. The *International Agenda for Botanic Gardens in Conservation* [14] sets out guiding principles for Botanic gardens worldwide to promote plant conservation through research and education. To monitor the implementation of this agenda, the BGCI launched a guiding document— 2010

*Targets for Botanic Gardens* —which urge the leaders of Botanic gardens worldwide to: (1) understand and document plant diversity, (2) conserve plant diversity, (3) Use plant diversity sustainably, (4) promote education and awareness about plant diversity and (5) build capacity for the conservation of plant diversity.

The Botanical Survey of India (BSI) was established in 1890 with the objectives of exploring the plant resources of the country and identifying plant species with economic virtue. In 1954, the Government reorganized the BSI with the objectives of (1) undertaking intensive floristic surveys and collecting accurate and detailed information on the occurrence, distribution, ecology and economic utility of plants in the country; (2) collecting, identifying and distributing materials that may be of use to educational and research institutions; and (3) acting as the custodian of authentic collections in well planned herbaria and documenting plant resources in the form of local, district, state and national flora [4]. Recently it has become a major focus of many. Botanical gardens offer opportunities for the study of ecological restoration, climatic change and even the relationship between human and nature. Nonetheless, the recurrent functions of Botanic gardens were research and education along with ex-situ conservation, as the major role of Botanical gardens.

#### Aspect of science education through Botanical garden

Botanic gardens can set up and implement environmental education programs within the framework of their infrastructure facilities. Each visitor in the garden becomes a student who explores estimates, experiments, and questions through learning centre activities. Visitors develop a skill of observation even if the visit is planned or for fun. Education in Botanic gardens can come in a variety of forms: children's summer camp, family programs, school programs such as field trips, teacher training and development, adult education and certification programs as well and student internships [8]. The natural environment has been considered as a robust educational site by many educationalists for centuries and school gardens and Botanic gardens are no exception. A number of the most influential Western educational philosophers and pioneer thinkers, such as Comenius, Rousseau, Pestalozzi, Froebel, Montessori and Dewey, viewed gardens as significant educational settings [11]-[13]. Maria Montessori (1870–1952) similarly addressed the educational function of gardens and advocated an active engagement with them, rather than a contemplative one [10]-[12]. She realized that children's gardens could be used beyond the standard curriculum to help to 'develop patience, enhance moral education, increase responsibility and improve appreciation for nature and relationship skills' [10]. Through the long historical period of emergence of educational philosophy, Botanical gardens became an important place for teaching and learning. John Dewey (1938) emphasized the salience of the children's experience and argued that educators must first understand the nature of human experience. He argued that

children should be involved in real-life tasks and challenges, such as outdoor excursions, weaving and construction in wood, and in particular, he noted the potential educational function of gardening [5]. David Livingstone's "Putting science in its place" included Botanic garden as part of his investigation into relationship between scientific practices [9].

#### Establishment and Development of RIE Botanical Garden

The program for establishment of Botanical garden was conservation, collection and propagation and to make the school children aware of the importance of conservation. The objective of the garden is to teach students to appreciate the value, benefits and beauty of various species of plants from an early age and to gradually instill in them an awareness of plant conservation.

The establishment of Botanical garden of RIE Bhubaneswar was initiated in the year 2015. The faculty members of Botany department, RIE, did an initial study under the PAC No. 17.01 in 2015-16 for developing the Botanical garden in view of children's outdoor science education. The proposal was screened and supported in the IAB meeting by the administration. The main idea of evolving a Botanical garden was instituted by two M.Sc. Ed. (LS) students Asmita De (2014-15) and Gurudeb Sethi (2015-16). The development took place at various phases.

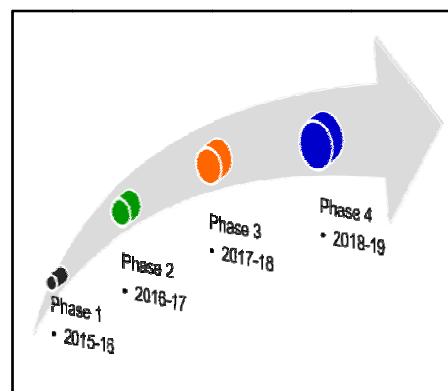


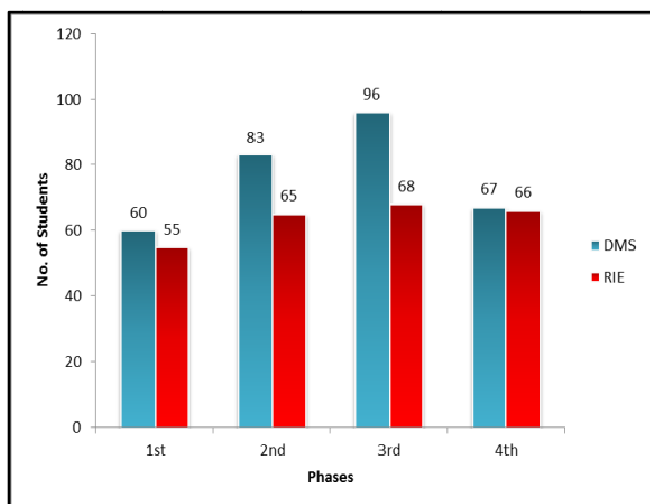
Figure 1: Phases of development of RIE Botanical garden.

In the first phase the students of Demonstration Multipurpose primary school students started the plantation in the garden. Various plant species were listed out and collected from the local nurseries of Odisha. In the next phase the elementary school students of Demonstration Multipurpose School carried forward the developmental work. The secondary children of DMS, in the third phase, maintained the initial establishment work and contributed greatly to its expansion. The Botanical garden is now in the fourth phase of development. Starting from 20 species, the garden has now accommodated more than 120 species of common, rare and endangered plant species. The students of RIE were there in every stages of development to carry the baton and also guide the DMS students. Various

programs were also conducted by the Botany department of RIE Bhubaneswar. Both the students of DMS and RIE actively participated in all the programs.

**Table 1: Number of students participated in the development of RIE Botanical garden**

Phases	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
No. of students of DMS	60	83	96	67
No. of students of RIE	55	65	68	66

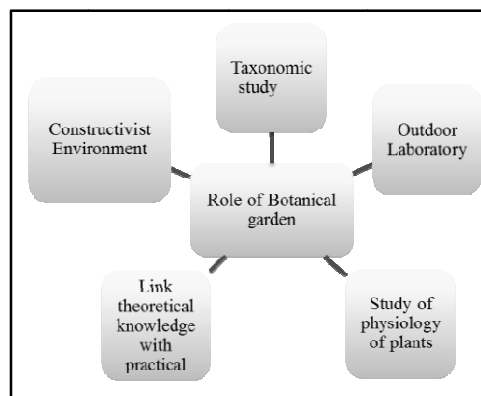


**Figure 2: Graph showing participation of students at various phases.**

### Role of Botanical garden in science education.

Education is a major part of the gardens programs and ranges from classes of young children to Ph. D researchers in Botanical and related sciences. For many teachers, the most important reason for undertaking Botanic garden visits is that they offer the opportunity to address topics listed in the science curricula [6]. Botanical garden maintains the living plant collection of different varieties. There are various roles which Botanical gardens play in science education. (1) It helps in taxonomic studies. Better understanding of taxonomy can be given to the students by providing them a visual mode of learning. (2) It serves as an outdoor laboratory for students and researchers. It supplies a wide range of plant species including seeds, Flowers, fruits etc. for research. (3) The students can learn about various physiological aspects of plants by observing the plants in the Botanical garden. (4) Visiting the Botanical garden helps the students to link their theoretical knowledge provided inside the classroom. This helps greatly in modification of their schema. (5) It creates a constructivist environment for the students which motivates and encourages them to learn enthusiastically.

Hence, a Botanic garden can serve as the context for making these links and for implementing environmental, global and developmental education [7].



**Figure 3. Flowchart showing the role of Botanical garden in science education.**

### Conclusion

The Botanical garden established within our Regional Institute campus which allows both students and teachers a continuous access to the plants and their products for teaching, learning and research. Since the garden activities are organized on-site, within the institute campus, Botanical garden can serve as a standard model for preservation of various species of plants. To achieve the objectives of the plant genetic resources, botany department RIE, campus arranged two day workshop to train and guide participating honors students and skill enhancement course students of under graduate course. Consecutively DMS children participated in the exploration of medicinal garden for preparation of models, charts, projects, working models, PowerPoint and video clipping. Hence Botanic gardens can be considered as a Learning Resource Centre with live examples. It is an exemplary, experimental and exploratory centre to facilitate the free flow of qualitative and quantitative information on all types of plants including medicinal, herbal, horticulture and floristic plants. Moreover it is a Learning laboratory that provides a framework for training in horticulture and tissue culture. Thus Botanic gardens can be considered as the Second biggest classroom in kind where good learning atmosphere exists without any impediments for school children and institute students.

### Acknowledgement

Our sincere thanks are due to Prof. P.C.Agarwal, Principal, RIE, Bhubaneswar, for guiding us and providing all the facilities. We also extend our thanks to Prof M.K.Satpathy, Dean, RIE, Bhubaneswar, for inspiration and encouragement. I extend my special thanks to my friends and juniors who helped me at various instances, while preparation of manuscript of this research paper.

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